Factors across the life course predict women's change in smoking behaviour during pregnancy and in midlife: results from the National Child Development Study

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ABSTRACT

Background: Tobacco smoking before, during and after pregnancy remains one of the few preventable factors associated with poor health outcomes for mothers and their children. We investigate predictors across the life course for change in smoking behaviour during pregnancy, and whether this change predicts smoking status in midlife.

Methods: Data were from the National Child Development Study (1958 British Birth Cohort). We included female cohort members who reported a first pregnancy up to age 33. Among 1,468 women who smoked before pregnancy, we examined predictors reported in childhood (age 11), adolescence (age 16) and early adulthood (age 23) of change in smoking behaviour from 12 months before to during pregnancy using log-binomial regression. The association between change in smoking behaviour during pregnancy and smoking status in midlife (age 55) was examined while adjusting for predictors across the life course.

Results: Among pre-pregnancy smokers (39%), 26% reduced and 35% quit smoking during pregnancy. Parental smoking and lower social class during childhood, and early adulthood lower social class, depression, early smoking initiation, high smoking intensity, living with a smoker, no pregnancy planning, and early motherhood were associated with lower probability of smoking reduction or cessation in pregnancy. Compared with women who smoked before and during pregnancy, women who reduced or quit were two times more likely to be non-smoker at age 55 (95% CI 1.76, 2.20).

Conclusions: Findings from this population-based birth cohort study lend support for smoking cessation strategies that target those at risk at various stages across the life course.

Key words: Birth cohort study; Epidemiology; Life course; Pregnancy; Smoking cessation

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What is already known on this subject?

- Maternal smoking before, during, and after pregnancy confers adverse health risks for both mothers and their children
- Factors during early life and adolescence – such as parental education and smoking – have been shown to predict smoking cessation in pregnancy directly or indirectly through adulthood exposures, depending on the population studied
- Quitting smoking in pregnancy is sustained in the postpartum period by some women, but the longer-term effects on smoking status remain unclear

What this study adds?

- Findings from this population-based birth cohort study reveal that exposures during early life, adolescence, and early adulthood are independent predictors of reducing and quitting smoking in pregnancy
- In turn, women who reduced or quit smoking in pregnancy were two times more likely to be non-smoker in midlife
- Tobacco screening and cessation services across the life course should address inequalities at different life stages, which may have an enduring influence on women's smoking behaviour and related health risks through to midlife

BACKGROUND

Reducing smoking rates is a priority for many national health systems as tobacco smoking remains a major preventable cause of disease and premature death worldwide (1, 2). The high prevalence of smoking among young women is of particular concern as it confers immediate as well as long-term adverse health risks for both mothers and their children (3). Even though smoking cessation rates among women are highest during pregnancy compared with any other life stage (4), 15-20% of reproductive-aged women in the UK and US were smokers in 2013 and 10-12% smoked during pregnancy (5, 6). Among women who stop smoking during pregnancy, the effect of smoking cessation has been found to dissipate after birth with 50-80% of women who quit during pregnancy resuming smoking within months after giving birth (7, 8). The longer-term impact of smoking cessation initiated during pregnancy on smoking status beyond the postpartum period remains largely unclear (9).

Better understanding of predictors across the life course for women's smoking behaviour is needed to inform targeted implementation of tobacco screening and cessation services. Childhood and adolescence are critical periods that determine women's lifetime circumstances and health behaviour (10). Thus far, studies that apply a life course approach to the understanding of smoking behaviour in women have mainly focused on socioeconomic influences. Childhood socioeconomic position (SEP) has been associated with adulthood smoking status in some studies (11, 12), whereas in other studies this was largely mediated through adulthood SEP (13, 14). In addition to SEP, evidence suggests that early and lone motherhood may influence smoking behaviour (13, 15). Other determinants may include parental smoking, physical and mental health during early life, and stressful life events (16, 17), however, it remains unclear if these are important predictors independent of disadvantages across the life course.

The current study uses data from the National Child Development Study (NCDS) to identify socioeconomic, psychological, health, and lifestyle factors across the life course that predict change in smoking behaviour during the first pregnancy, and to examine whether this change predicts smoking status in midlife.

METHODS

Study population

The NCDS is an ongoing longitudinal birth cohort study comprised of over 17,000 live births in Great Britain during one week in 1958 (18). Since the birth survey, cohort members have been followed-up ten times using parental interviews and examinations at ages 7, 11 and 16 years and by cohort member interviews at ages 23, 33, 42, 44, 46, 50 and 55 years. Although non-respondents at follow-up surveys were more likely to have lower educational attainments and live in more disadvantaged circumstances, the sample remained broadly representative of the surviving cohort (19).

Detailed data on pregnancies of female cohort members were collected at age 33 years in 1991. Of the 16,240 cohort members who were eligible for the 1991 survey, 11,407 agreed to be interviewed (70.2%) (Figure S1). Of these, 5,802 (50.9%) were women, of whom 4,677 had given birth by age 33 (80.6%). Women with missing data on smoking behaviour in pregnancy (n = 283), smoking status at age 55 (n = 108), or with no information on predictors (n = 534), were excluded. A sample of 3,752 women was available for longitudinal analyses.

Smoking behaviour

At age 33 years, women were asked for each pregnancy whether they had smoked cigarettes in the 12 months before pregnancy. Pre-pregnancy smokers were then asked if they had changed their smoking behaviour during pregnancy (quit, or reducing number of cigarettes) or continued

smoking as before pregnancy. At age 55 years, current smoking status was assessed as non-smoker, smoker <20 cigarettes per day, or smoker ≥20 cigarettes per day.

Predictors across the life course

Predictors at different life stages were selected based on previous research on determinants of smoking cessation in pregnant and non-pregnant populations (20, 21).

Early life and adolescence

Data collected at birth and age 11 were used to reflect early life predictors. For the majority of women these reflect characteristics before starting smoking (median (interquartile range (IQR)): 16 (15-18) years). If no data were available on predictors at age 11, data at age 16 were used.

Mothers' smoking habits during pregnancy of the cohort member was assessed at the birth survey completed by the midwife. Childhood socioeconomic conditions were based on mother and father social class at age 11 determined using the Registrar General's classification of occupations. Through parental interviews, information on stressful life events including parental chronic illness or death (age 11), being bullied by other children (age 11), and parental divorce (age 16) were assessed. Childhood psychological health was assessed at age 11 using the teacher-rated Bristol Social Adjustment Guide (BSAG) (22). The sub-scale on depression was used in this study as a quantitative assessment reflecting depressive symptoms during childhood. A medical officer obtained information on history of asthma or bronchitis, and measured the child's height and weight. BMI was calculated as weight (kg) divided by the square of height (m) and categorised as healthy weight and overweight or obese according to BMI charts for UK girls aged 11 (23). Tests of cognition and educational ability were administered by teachers when the children were 11 years old including a verbal and non-

verbal general ability test, reading comprehension test, and mathematics test. Data on parental smoking and cohort member's alcohol consumption were collected at age 16.

Early adulthood and midlife

Data collected at age 23 were used to reflect early adulthood predictors, as this was before the age of first pregnancy for most women (median (IQR): 24 (21-27) years). Additional predictors for smoking status at age 55 were taken from the 2013 survey.

Early adulthood marital status was based on the survey closest to the time of first pregnancy. Psychological distress was measured at ages 23 and 55 years with the 24-item Malaise Inventory, with a score of ≥7 indicating high level of distress (24). Reproductive characteristics including age at first pregnancy and whether the first pregnancy was planned were assessed at age 33, and information on the total number of children was taken from surveys up to age 55. Data on smoking related predictors including age started smoking were taken from multiple surveys. The number of cigarettes smoked before the first pregnancy was reported at age 33, and whether women lived in a household with a smoker was taken from the survey closest to the time of first pregnancy.

Statistical analysis

Childhood, adolescence and early adulthood characteristics of women were described according to smoking status 12 months before the first pregnancy, and compared using t-tests or chi-square tests.

Preliminary analysis using multinomial logistic regression indicated that similar factors predicted reducing and quitting smoking compared with continuing smoking in pregnancy, and with smoking <20 cigarettes and ≥20 cigarettes compared with no smoking in mid-life (data not shown). We therefore analysed these outcomes as binary variables. Log-binomial regression

models were used to examine predictors of change in smoking behaviour from 12 months before to during the first pregnancy among pre-pregnancy smokers (reduced or quit smoking compared with continued smoking), and smoking status in midlife (non-smoker compared with smoker). First, univariate analysis was used to examine predictors of change in smoking behaviour from before to during the first pregnancy, and only predictors that were strongly significant (P <0.01) were retained for multivariable analyses. Second, two separate multivariable analyses were performed for predictors in early life and adolescence (Model 1), and for predictors in early adulthood (Model 2). Factors that remained significant in each of these mutually adjusted models were then combined in a final multivariable model (Model 3). Lastly, we examined if a change in smoking behaviour during the first pregnancy predicted smoking status in midlife, while adjusting for relevant early life, adolescence and early adulthood factors as well as covariates at age 55 years.

Sensitivity analyses were conducted to test the consistency of our results. The final model for the association of change in smoking behaviour during the first pregnancy with smoking status in midlife was additionally adjusted for the mixed mode design of the age 55 survey (web versus telephone completion). Moreover, log-binomial regression analyses were conducted on all potential predictors regardless of significance in univariate models to test for a potential bias due to negative confounding. Lastly, a multiple imputation analysis was performed to assess the influence of participant exclusions that resulted from missing predictor data (n = 534 (12.5%)) (25).

RESULTS

The mean age at first pregnancy was 24 years (SD 4.3). More than one third of the women (39.1%) smoked in the 12 months before pregnancy (Figure 1). Childhood and early adulthood

characteristics of women who smoked before their first pregnancy compared with non-smokers before pregnancy are shown in Table 1.

Predictors across the life course of change in smoking behaviour during first pregnancy

Among women who smoked before their first pregnancy, the majority of women continued smoking during pregnancy (65.1%) (Figure 1). Even though 26.4% reduced the number of cigarettes, 38.7% continued to smoke similar number of cigarettes as before pregnancy. Univariate regression analysis identified associations of a wide range of early life and early adulthood predictors with changes in smoking behaviour during the first pregnancy (Table S1).

Multivariable adjustment indicated significant associations of both early life and early adulthood predictors with reducing or quitting smoking during the first pregnancy after mutual adjustment (Table 2, Model 3). Women with a father who smoked >10 cigarettes per day were 14% less likely to reduce or quit smoking (95% CI 0.79, 0.93). Compared with a father with non-manual social class, manual social class (RR 0.84, 95% CI 0.76, 0.93) and absence or retirement of the father (RR 0.85, 95% CI 0.78, 0.93)) were associated with lower probability of smoking reduction or cessation. Each SD increase in reading comprehension test score was associated with 13% lower probability of reducing or quitting smoking during pregnancy (95% CI 0.83, 0.91). Predictors during early adulthood associated with lower probability of smoking reduction or cessation were manual social class (RR 0.81, 95% CI 0.75, 0.87), depressive symptoms (RR 0.82, 95% CI 0.74, 0.91), starting smoking ≤16 years (RR 0.83, 95% CI 0.78, 0.89) and living with another smoker (RR 0.84, 95% CI 0.79, 0.90). Moreover, women who did not plan their first pregnancy (RR 0.84, 95% CI 0.79, 0.90) and those who were pregnant for the first time between ages 21-24 years (RR 0.83, 95% CI 0.77, 0.90) or ≤20 years (RR 0.79, 95% CI 0.72, 0.86) compared with ≥25 years, were less likely to reduce or quit smoking. Smoking intensity before pregnancy was the strongest predictor, with a 24% (95% CI 0.69,

0.83) lower probability of smoking reduction or cessation for women who smoked ≥20 cigarettes per day compared with ≤10 cigarettes per day.

Change in smoking behaviour during first pregnancy and smoking status in midlife

Among women who smoked before their first pregnancy, 54.8% were current smokers at age 55 years. Moreover, among women who quit during their first pregnancy, 38.1% smoked at age 55 years (Figure 1). Compared with women who smoked before and during their first pregnancy, women who reduced or quit during pregnancy were two times more likely to be non-smoker at age 55 (RR 1.96, 95% CI 1.76, 2.20), after adjustment for significant predictors across the life course.

Our results were consistent in sensitivity analyses. Adjustment for the mixed mode design of the age 55 survey, mutual adjustment of all potential predictors regardless of significance in univariate models, and multiple imputation of predictor data, did not alter our conclusions (data not shown).

DISCUSSION

Findings from this population-based birth cohort study show that exposures during early life, adolescence and early adulthood are predictors of reducing and quitting smoking during the first pregnancy among women who smoked prior to pregnancy. Moreover, our results indicate that smoking reduction or cessation during the first pregnancy predicts long-term smoking status in midlife. Women who reduced or quit smoking during their first pregnancy were two times more likely to be a non-smoker at age 55.

Our findings confirm associations of several conventional predictors during early life and adulthood with smoking cessation during pregnancy. Smoking related behaviours, including parental smoking, early smoking initiation, high smoking intensity before pregnancy, and living

with a smoker, were strong predictors of smoking reduction and cessation during pregnancy (14, 16, 26). Consistent with previous studies, our results indicate the significance of early motherhood as a predictor of smoking in pregnancy (13, 15). Lower SEP is another well-established predictor of maternal smoking (11, 12), although not all studies have shown an association for childhood SEP independent of adulthood SEP (13-15, 27). Women with lower father's social class, reading comprehension ability during childhood, and early adulthood social class were less likely to reduce or quit smoking during pregnancy in our study. A combination of characteristics of women with lower SEP may explain the lower rates of smoking reduction and cessation, including poorer circumstances, less knowledge and skills related to making healthy behaviour choices, larger network of family and friends who are smokers, coping with stress, and lower uptake and later initiation of prenatal care and cessation treatment.

The role of maternal psychological characteristics has been less well investigated in limited number of cross-sectional studies (28, 29). Childhood and early adulthood depressive symptoms were each associated with lower probability of quitting and reducing the number of cigarettes during pregnancy in our study. Evidence on the effectiveness of cessation interventions in pregnant women with psychological problems is inconclusive as current evidence is limited to few small clinical trials (30).

Pregnancy planning was also identified as a predictor of reducing and quitting smoking in pregnancy. Growing evidence suggests that preconception planning and care may improve women's lifestyle behaviour (31), although smoking behaviour is often not discussed with health care providers (32, 33). Screening for poor lifestyle behaviours such as smoking, and improving awareness of adverse health consequences among women of childbearing age may increase the number of women who plan and prepare for pregnancy (34, 35).

In addition to the 35% of pre-pregnancy smokers who quit during their first pregnancy, we demonstrate that a substantial proportion of 26% changed their behaviour by reducing smoking intensity, from a mean of 15 to six cigarettes per day. Similar factors predicted changes in maternal smoking behaviours including both reducing the number of cigarettes and completely quitting smoking . Even though any degree of lowering the number of cigarettes during pregnancy may confer health benefits, a reduction to fewer than eight cigarettes per day is necessary to decrease rates of low birth weight (36), which was not achieved by 35% of the women who reduced smoking in our population.

Limited evidence is available on the influence of change in smoking behaviour during pregnancy on long-term smoking status beyond the post-partum period. Although one previous study did not find an association between smoking cessation during pregnancy and smoking status three years later, this was estimated in comparison to smokers who were not pregnant (37). In line with our findings, the Mater-University of Queensland Study of Pregnancy (MUSP) cohort that followed 2,992 women who smoked before pregnancy, found that those who quit during pregnancy (mean age 24 years) were two to four times more likely to be a non-smoker at 5, 14, and 21 years follow-up after adjustment for adulthood predictors (9).

Our study is based on a representative sample of women from the UK enabling us to examine population-level determinants of smoking behaviour. The unique long-term follow-up of women from birth through to midlife provided the opportunity to examine early life and adulthood predictors in relation with change in smoking behaviour during pregnancy, and subsequent prediction of smoking status in midlife.

Several limitations of our study should be acknowledged. First, the use of self-reported smoking behaviour before, during and after pregnancy may have resulted in reporting and recall biases. Nondisclosure of smoking does not appear to be significant among non-pregnant

247 women (38), however, the prevalence of smoking among pregnant women may be
248 underreported and thereby have led to underestimation of the strength of the associations.
249 Patters of underreporting, however, have been found to be consistent across socioeconomic
250 groups (39). Second, our study examines changes in smoking behaviour among the generation
251 of women who had their first pregnancies between 1970 and early 1990. Although smoking
252 rates have declined since, smoking prevalence during pregnancy remains high and predictors of
253 change in smoking behaviour are unlikely to have changed. As socioeconomic inequalities in
254 smoking initiation and cessation have increased across consecutive birth cohorts (40), it may be
255 possible that inequalities are larger in younger generations. Third, our analysis only included
256 live births, and we may therefore have excluded the heaviest smoking women where failure to
257 give birth resulted from heavy smoking. Moreover, detailed information on smoking during
258 pregnancy was available only at age 33, and pregnancies among older first-time mothers were
259 therefore not included. However, among all women who reported a pregnancy during the study
260 (89%), 92% reported their first pregnancy before age 33. Smoking status at age 23 did not
261 appear to differ between women who did vs. did not report a pregnancy during the study (P =
262 0.25) or who reported their first pregnancy ≤33 years vs. >33 years (P = 0.12). Furthermore,
263 early adulthood factors at age 23 were included in the analysis as predictors of subsequent
264 change in maternal smoking behaviour, however, 37% of women had their first pregnancy prior
265 to age 23 and the analysis therefore assumes that predictors were constant over time for these
266 women. Lastly, the four to 10 year survey intervals enabled the study of long-term predictors of
267 smoking behaviour, however, short-term changes that may influence quitting behaviour may
268 have been missed.

269 In this population-based birth cohort study we demonstrate that the probability of women
270 reducing or quitting smoking during their first pregnancy may be predicted by exposures during
271 childhood, adolescence and early adulthood. These results emphasise the need for

implementation of tobacco screening and cessation services that target those at risk at various stages across the life course. Despite these inequalities, our findings indicate that smoking reduction or cessation during pregnancy may predict women's smoking behaviour through to midlife, highlighting that pregnancy may represent an opportunity for long-term cessation among pre-pregnancy smokers. Nevertheless, the high rates of women who fail to quit smoking during pregnancy lend support for prevention efforts that further reduce the number of young women who begin smoking.

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Ethics approval and consent to participant: Multicentre Research Ethics Committee (MREC) approval was sought for NCDS follow-ups from 2000 on. The 1958 and 1965 follow-ups pre-dated the establishment of ethics committees; the 1969, 1974, 1981 and 1991 follow-ups came before the establishment of the MREC system. Internal ethical reviews were undertaken for these waves. Participants in later waves were required to sign informed consent, and ethical approval was obtained from South East and London Multicentre Research Ethics Committee. (Shepherd, P.M. An Introduction to the Background to the Study and Methods of Data Collection in The National Child Development Study. Social Statistics Research Unit. London City University 1985). NCDS sought informed parental consent for the 7-year (1965), 11-year (1969) and 16-year (1974) surveys.

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FIGURE LEGEND

Figure 1. Smoking status among women in the National Child Development Study 12 months before pregnancy, during the first pregnancy, and at age 55 years.
The different colours represent smoking status and indicate 1) the percentage of women in each category, and 2) change in smoking status.

TABLES

Table 1. Childhood, adolescence and early adulthood characteristics of study participants according to smoking status before first pregnancy, N = 3,752

	Smoking status 12 months before first pregnancy		
	Non-smoker *n* = 2,284 (60.9%)	Smoker *n* = 1,468 (39.1%)	*P*-value[a]
Smoking behaviour over the life course			
Smoking status during first pregnancy			<0.0001
Non-smoker	n/a	n/a	
Continued smoker	n/a	38.7	
Reduced smoking	n/a	26.4	
Quit smoking	n/a	34.9	
Age started smoking			<0.0001
>16 years	n/a	21.5	
≤16 years	n/a	78.5	
Number of cigarettes in year before first pregnancy			<0.0001
≤10 cigarettes /day	n/a	18.0	
11-19 cigarettes /day	n/a	47.4	
≥20 cigarettes /day	n/a	34.6	
Other smoker in household[b]	21.7	52.0	<0.0001
Smoking status at age 55 years			<0.0001
Non-smoker	94.9	46.3	
Smoker <20 cigarettes/day	2.8	28.2	
Smoker ≥20 cigarettes/day	2.4	25.5	
Early life and adolescence (age 11 or 16)			
Parental characteristics			
Mother's smoking status during pregnancy			<0.0001
Non-smoker	69.3	61.1	
Smoker	30.7	38.9	
Mother's smoking status			<0.0001
Non-smoker	66.5	57.1	
Smoker ≤10 cigarettes/day	13.0	16.1	
Smoker >10 cigarettes /day	20.5	26.8	
Father's smoking status			<0.0001
Non-smoker	56.2	51.1	
Smoker ≤10 cigarettes /day	19.7	16.5	
Smoker >10 cigarettes /day	24.1	32.4	
Mother's social class			0.005
Non-manual (class I, II and III non-manual)	27.1	22.8	
Manual (class III manual, IV and V)	26.4	29.4	
No mother or n/a (e.g. no work)	46.5	47.8	
Father's social class			<0.0001
Non-manual (class I, II and III non-manual)	28.5	20.8	
Manual (class III manual, IV and V)	47.9	52.6	
No father or n/a (e.g. no work)	23.6	26.6	
Life events and mental health			
Parental divorce	14.0	22.2	<0.0001
Chronic illness or death of mother or father	10.5	13.6	0.002
Bullied sometimes or often by other children	16.8	18.7	0.11
BSAG Depression Syndrome score (range 0-10)	0.7 (1.3)	1.1 (1.6)	<0.0001
Health and lifestyle characteristics			
Ever had asthma or bronchitis	9.5	8.6	0.32
Body mass index			0.008

	Smoking status 12 months before first pregnancy		
	Non-smoker *n* = 2,284 (60.9%)	Smoker *n* = 1,468 (39.1%)	*P*-value[a]
Healthy weight, ≤91th centile (≤24.5 kg/m^2)	90.5	87.4	
Overweight or obese, >91th centile (>24.5 kg/m^2)	9.5	13.6	
Time since last alcoholic drink			0.03
More than one week	24.9	20.6	
Less than one week	46.2	49.2	
Never had alcoholic drink	28.9	30.2	
Cognition and educational ability			
General ability test score (range 0-80)	46.4 (15.1)	41.5 (15.4)	<0.0001
Reading comprehension test score (range 0-35)	16.5 (5.6)	14.9 (5.6)	<0.0001
Mathematics test score (range 0-40)	17.6 (9.9)	14.4 (9.3)	<0.0001
Early adulthood (age 23)			
Social factors			
Own social class			<0.0001
Non-manual (class I, II and III non-manual)	74.9	56.9	
Manual (class III manual, IV and V)	25.1	43.1	
Marital status[b]			<0.0001
Married	89.1	79.9	
Separated, widowed or divorced	5.4	9.4	
Single	5.5	10.7	
Health, reproductive and lifestyle characteristics			
Self-rated general health status			<0.0001
Excellent	46.5	34.4	
Good	45.9	50.7	
Fair/poor	7.6	14.9	
Ever had asthma or bronchitis	17.2	21.3	0.0007
Depression (Malaise Inventory score 8-24)	7.7	15.3	<0.0001
Weight perception			<0.0001
Right	45.7	39.3	
Underweight	6.6	10.2	
Overweight	37.7	39.2	
Very overweight	10.0	11.3	
Alcohol consumption frequency			0.0003
1-2 times or less per week	85.8	86.2	
Most days	7.3	9.5	
Never	6.9	4.3	
First pregnancy not planned	72.5	54.8	<0.0001

n/a, not applicable. Values are mean (SD) or %

[a] *P*-values from t-test or chi-square test

[b] Survey prior to age at first pregnancy

Table 2. Relative risks (95% CI) for early life, adolescence and early adulthood factors predictors of change in smoking behaviour from 12 months before to during the first pregnancy among pre-pregnancy smokers, N = 1,468

	Continued smoking *n* = 568 (38.7%)	Reduced or quit smoking *n* = 900 (61.3%)		
		Model 1 Early life and adolescence	Model 2 Early adulthood	Model 3 Early life, adolescence and early adulthood
Early life and adolescence				
Parental characteristics				
Mother's smoking status during pregnancy				
Non-smoker	ref	ref		
Smoker	ref	0.94 (0.85, 1.05)		
Mother's smoking status				
Non-smoker	ref	ref		
Smoker ≤10 cigarettes /day	ref	0.93 (0.82, 1.06)		
Smoker >10 cigarettes /day	ref	0.89 (0.75, 1.03)		
Father's smoking status				
Non-smoker	ref	ref		ref
Smoker ≤10 cigarettes /day	ref	0.96 (0.85, 1.08)		0.95 (0.88, 1.03)
Smoker >10 cigarettes /day	ref	0.81 (0.71, 0.92)		0.86 (0.79, 0.93)
Mother's social class				
Non-manual (class I, II and III non-manual)	ref	ref		
Manual (class III manual, IV and V)	ref	0.89 (0.81, 1.00)		
No mother or n/a (e.g. no work)	ref	0.90 (0.80, 1.01)		
Father's social class				
Non-manual (class I, II and III non-manual)	ref	ref		ref
Manual (class III manual, IV and V)	ref	0.79 (0.67, 0.93)		0.84 (0.76, 0.93)
No father or n/a (e.g. no work)	ref	0.78 (0.69, 0.88)		0.85 (0.78, 0.93)
Life events and mental health				
Parental divorce	ref	0.90 (0.80, 1.01)		
Chronic illness or death of mother or father	ref	0.91 (0.81, 1.03)		
BSAG Depression Syndrome score[a]	ref	0.82 (0.78, 0.87)		1.00 (0.97, 1.03)
Education				

	Continued smoking *n* = 568 (38.7%)	Reduced or quit smoking *n* = 900 (61.3%)		
		Model 1 Early life and adolescence	Model 2 Early adulthood	Model 3 Early life, adolescence and early adulthood
General ability test score[b]	ref	0.97 (0.90, 1.04)		
Reading comprehension test score[b]	ref	0.78 (0.72, 0.84)		0.87 (0.83, 0.91)
Mathematics test score[b]	ref	0.98 (0.91, 1.07)		
Early adulthood (age 23)				
Social factors				
Own social class				
Non-manual (class I, II and III non-manual)	ref		ref	ref
Manual (class III manual, IV and V)	ref		0.72 (0.65, 0.80)	0.81 (0.75, 0.87)
Marital status[c]				
Married	ref		ref	
Separated, widowed or divorced	ref		0.95 (0.79, 1.14)	
Single	ref		0.97 (0.83, 1.12)	
Health and lifestyle characteristics				
Self-rated general health status				
Excellent	ref		ref	
Good	ref		0.91 (0.76, 1.09)	
Fair/poor	ref		0.97 (0.91, 1.03)	
Depression (Malaise Inventory score 8-24)	ref		0.73 (0.61, 0.87)	0.82 (0.74, 0.91)
Weight perception				
Right	ref		ref	
Underweight	ref		0.97 (0.90, 1.03)	
Overweight	ref		0.89 (0.78, 1.02)	
Very overweight	ref		0.90 (0.80, 1.01)	
Age at first pregnancy				
≥25 years	ref		ref	ref
21-24 years	ref		0.73 (0.65, 0.81)	0.83 (0.77, 0.90)
≤20 years	ref		0.66 (0.57, 0.76)	0.79 (0.72, 0.86)
First pregnancy not planned	ref		0.80 (0.73, 0.89)	0.84 (0.79, 0.90)

	Continued smoking *n* = 568 (38.7%)	Reduced or quit smoking *n* = 900 (61.3%)		
		Model 1 Early life and adolescence	Model 2 Early adulthood	Model 3 Early life, adolescence and early adulthood
Smoking behaviour				
Age started smoking				
>16 years	ref		ref	ref
≤16 years	ref		0.85 (0.79, 0.92)	0.83 (0.78, 0.89)
Number of cigarettes in year before first pregnancy				
≤10 cigarettes /day	ref		ref	ref
11-19 cigarettes /day	ref		0.82 (0.75, 0.89)	0.85 (0.78, 0.92)
≥20 cigarettes /day	ref		0.61 (0.53, 0.69)	0.76 (0.69, 0.83)
Other smoker in household[c]	ref		0.84 (0.77, 0.91)	0.84 (0.79, 0.90)

BSAG, British Social Adjustment Guide

[a] Per SD increase in score

[b] Per SD decrease in score

[c] Survey prior to first pregnancy